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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 45.] SEPTEMBER. [1890.

CLXII.—INSECT INJURY TO BARREL STAVES.

Specimens of oak-staves which had formed part of a beer barrel were recently received at Kew from the India Store Department. The barrel was made in the early part of 1889, filled with malt liquor in the autumn, and shipped with others as Government stores in March 1890 to Calcutta. The authorities at Calcutta reported, in regard to the consignment, that "some casks were found to be attacked by wire worm or borer" and the contents spoiled. The question arose whether the casks were unsound when they were shipped from this country or whether they had been attacked on board ship during the voyage out. As questions of similar character had arisen on former occasions, it was considered desirable to have the circumstances thoroughly investigated and to trace, as far as possible, the nature and causes of the injury. The results of the investigation are given very fully in a Report which has been prepared by Mr. W. F. H. Blandford, F.E.S., Lecturer on Entomology at the Indian Civil Engineering College, Cooper's Hill. It will be noticed that notwithstanding the somewhat scanty material that was available, Mr. Blandford has very skilfully traced the cause of the injury, and probably also identified the particular insect concerned. Further, he has shown that the injury to the wood had occurred before

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it was worked up into barrels, although, owing to the very minute holes made by the insects it was almost impossible to detect their presence.

ROYAL GARDENS, KEW, to INDIA OFFICE.

SIR, Royal Gardens, Kew, 19 July 1890.

I AM desired by Mr. Thiselton Dyer to inform you that he has received from the Superintendent of the India Store Department correspondence on the subject of injuries to staves of beer barrels noticed in a recent consignment made to Calcutta.

2. Some of the staves received from India were brought to Kew by by Mr. W. H. Hooker, and they were submitted for examination to Mr. W. T. H. Blandford, F.E.S., Lecturer on Entomology at the Indian Civil Engineering College, Cooper's Hill.

3. Mr. Blandford's Report, a copy of which is herewith enclosed, is an able and conclusive document. The cause of the injuries complained of is clearly traceable to the attacks of a small beetle known as *Trypodendron signatum*, Fabr., which had bored into the wood, and thus in some cases when the wood was worked up produced a continuous channel between the outside and inside of the barrels. This beetle is known as attacking newly-felled oak timber, and is recognised amongst other characteristics by the peculiar series of short chambers made by its larvæ at the extremity of the burrow. One of these burrows was found by Mr. Blandford in the oak staves received at Kew, and a drawing of it is given in the Report.

4. The perforations made by the beetle are exceedingly minute, and they can only be detected by a very searching examination. It would be almost impossible for an officer charged with the duty of inspecting a large number of barrels to detect one, two, or three of these perforations in each barrel, and especially when (as shown in the present instance) they are covered over by the hoops. The injury to the oak staves must, however, have been apparent at the time they were worked by the coopers, as one of the burrows had been carefully plugged externally with a small wooden plug.

I am, &c.

A. Godley, Esq., C.B. (Signed) D. MORRIS.

REPORT on Two Pieces of BEER-CASK (1-inch Oak-staves) pierced by a Boring Insect.

There appears to be six burrows in all running straight through the pieces of cask from * side to side. I cut down upon and examined them all from end to end.

Five burrows are simple vertical channels from * side to side; some marked with beer-staining, some not. One was carefully plugged externally with a small wooden plug. Another was packed in its outer half by the chewed débris left by a boring insect.

Several had in them examples of an insect which, however, has had nothing to do with the boring; they are young larvæ of earwigs or some such insect which have crawled into the holes subsequently.

The remaining two holes (A. B.) on the outside and inside of the stave respectively were found on examination not to correspond.

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* From outside to inside or the reverse.

The hole on the inside (A.) runs to within a sixteenth of an inch of the outside and there stops. From it come off a series of blind chambers along the grain of the wood at right angles to it, and on both sides. Each chamber is from $\frac{1}{12}$ to $\frac{1}{4}$ of an inch in length, and about the width of the parent-hole. The number of chambers is about 14, but it has been necessary to cut away some of them to allow of the complete examination of the others. No part whatever of this system communicates with the outside of the cask. It can only have been exacavated before the cask was filled with beer; and, judging from its complexity and from the fact that it contains no dead insects or larvæ, I have very little doubt that it was commenced while the oak was still in plank and completed before the cask was used.

The system of boring seems to me to be absolutely diagnostic of a beetle known as *Trypodendron signatum*, Fabr., or one of its cogeners, *T. domesticum*.

The last hole is commenced on the outside of the cask, and only extends a little way into the wood; it contained the remains of a dead beetle, which though very fragmentary are sufficient to confirm me in my opinion that the boring insect is *Trypodendron signatum*, Fabr.

This insect is not considered to be common in England; and has never been recorded as destructive. It is, however, easily overlooked, as little attention is here paid to such insects.

It is known to foresters on the Continent as attacking newly-felled oak timber (and other woods) and seriously damaging it when in baulks; it bores vertically into the timber for about three or four inches, and at the extremity of the burrow is constructed a series of short chambers by its larvæ, as in this case.

It usually attacks timber which is comparatively fresh, and is not in the least likely to attack for the first time timber on shipboard.

That the damage was at least begun when the cask was constructed I conclude from the fact that three holes, including the incomplete hole B., open on the outside of the wood where it has been covered by the hoops of the cask. The marks of these hoops are so distinct, and they have evidently fitted so tightly, that I think it quite impossible that the insect should have begun to bore after they were put on.

With regard to the fact that leakage was not noticed directly the beer was put into these unsound casks (if such is the case), I make the following suggestions by way of explanation:—

1. A certain number of holes may have been partly made from the outside, which were subsequently completed by the beetle after the cask was filled.

2. The beetle holes after being bored are left filled with a dense mass of comminuted wood (visible in one hole now), which may have been sufficient to keep in the beer for a time till increase of pressure in the cask from the beer working, or being kept in a warmer climate, forced it out.

From the examination of these two pieces of wood I conclude:—

1. That the borings are caused by a beetle, *Trypodendron signatum*, Fabr.
2. That they were commenced at the time of construction of the cask.
3. That the cask was unsound when filled with beer.
4. That injury received by insects on board ship has nothing whatever to do with it.

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The beetles of the genus *Trypodendron*, Stephens, belong to the family of the *Scolytidæ*, or bark beetles, and to the sub-family *Tomicidæ*, in which the head is concealed under a convex thorax, and is almost invisible when looked at from above.

They are cylindrical in form, and of small size (1 to 1½ lines in length).

The head bears a pair of antennæ consisting of a long basal joint nearly equal in length to the five remaining joints, which are inserted at right angles to it; of these five joints the first four are very short, the terminal joint is large, flattened, and oval or triangular (Fig. 1).

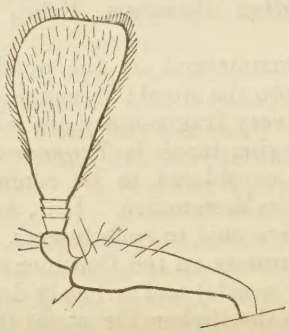

Fig. 1. Antenna of *Trypodendron* showing characteristic terminal joint.

The eyes are each completely divided into two parts by a horizontal septum, at the anterior end of which the antenna is inserted.

The thorax is very convex and nearly hemispherical, covered all over with "asperate" punctuation.

This is very characteristic of many of the *Tomicidæ*, and has in miniature the appearance which would be produced by pecking the surface of a convex block of wood with forward strokes of a small chisel or gouge, so as to cover it with a number of small backwardly-directed splinters.

The elytra are cylindrical, covered with rows of punctures; they have no striate impression close to the suture, and no excavations nor teeth at their apex, features occurring in most of the *Tomicidæ*.

The legs are short, strong, and flattened; the tibiæ are toothed externally, and the tarsi have four simple joints.

Careful examination is required to distinguish them from other *Tomicidæ*, or indeed from wood-boring beetles of other families; the structure of the antennæ and the asperate thorax covering the head will indicate the family, and the division of the eyes and absence of any sutural stria or apical excavation of the elytra the genus.

When the species are found *in situ*, their galleries, with the series of short larval chambers above and below (Fig. 2), will at once indicate the genus.

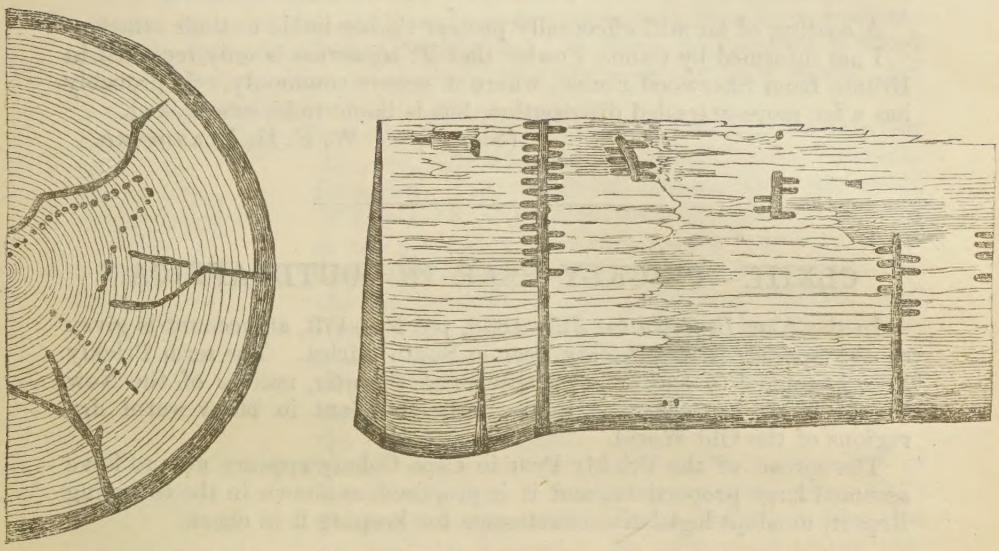

Fig. 2. Horizontal and radial sections of oak stem showing burrows of *Trypodendron.*

There are three European species, which may be distinguished as follows :—

I. Thorax uniformly black ; elytra yellow with black margins ; terminal joint of antenna with apex produced at inner angle. On deciduous trees. *T. domesticum*, Linn.

At least posterior half of thorax yellow. Elytra yellowish, with a dark longitudinal stroke along middle.

i. Elytra with deep and somewhat wrinkled punctured striæ ; terminal point of antenna elongate triangular, produced at inner angle of apex. In deciduous trees. *T. signatum*, Fabr. (*quercus*, Eich.).

ii. Elytra with very fine rows of punctures ; terminal joint rounded at apex of antennæ. In conifers. *T. lineatum*, Oliv.

Of the two species living on deciduous trees, *T. domesticum* attacks principally beech, rarely oak, birch, alder, maple, &c.

T. signatum occurs generally in oak, also in birch, beech, hazel, &c.

Either of these two species may have attacked the wood of these casks. The mutilated and discoloured fragments of the one insect found leave it a matter of doubt as to whether it is *T. domesticum* or *T. signatum*, but the strong punctuations of the elytra (almost the only point available for differentiation) indicate the latter.

They are similar in habit, and the distinction between them is of no economical importance.

They do not injure the life or nutrition of a tree, but by confining their attacks to dead or dying timber they render it unfit for commercial purposes.

Little can be done to diminish their numbers in places where they occur except by carefully clearing away branches, stumps, and other dead wood in which they can breed. Newly-felled timber should be exposed as little as possible to their attacks during their flight time, which is in middle Europe in May and June and again in August and September. Selected trees or branches can be left out for the beetles to lay their eggs in and may then be destroyed by fire with the enclosed broods.

A coating of tar will effectually protect timber liable to their attacks.

I am informed by Canon Fowler that *T. signatum* is only recorded in Britain from Sherwood Forest, where it occurs commonly. It probably has a far more extended distribution, but is liable to be overlooked.

(Signed) W. F. H. Blandford.

CLXIII.—PRICKLY PEAR IN SOUTH AFRICA.

In the *Kew Bulletin* for July 1888, pp. 165–173, an account is given of the spread of the Prickly Pear in South Africa. The term Prickly Pear is applied to one or more species of *Opuntia*, natives of the New World which have become increasingly abundant in many warm dry regions of the Old World.

The spread of the Prickly Pear in Cape Colony appears now to have assumed large proportions, and it is proposed, as shown in the following Report, to adopt legislative enactments for keeping it in check.

Report of the Select Committee appointed by the Legislative Council on the 9th June 1890, to consider the Subject of the Eradication of the Prickly Pear and the Poisonous Melkbosch. The Committee consisting of Messrs. Botha, Du Plessis, Bowker, Herholdt, Meurant, and Wilmot.

Your Committee find, from evidence which has been adduced before them, and which is published with this Report :—

"i. That in the districts of Graaff-Reinet, Somerset East, Cradock, Jansenville, Uitenhage, Willowmore, and Aberdeen the plant known as Prickly Pear has increased, and is increasing, to an alarming extent. This is rendered more serious by the fact that this plant, after having been for many years in a district seems to obtain a complete mastery, although in the first instance no fear whatever is entertained respecting it.

"ii. The interest of the neighbouring divisions, and indeed the whole country, is involved in this matter, because past experience shows that unless taken in time 'the Prickly Pear' must spread over all the adjoining areas. It is therefore a pest which ought to be extirpated at once, not merely for the sake of those districts in which it is at present so hurtful, but for the sake of the adjoining districts and for the entire Colony. The fact that 'the Prickly Pear' specially fastens upon good land and is at present destroying portions of the best and most fertile land, public and private, which the Colony possesses, has to be taken into consideration.

"iii. We have it in evidence that the depreciation of property in certain districts has already reached at least fifty per cent., while all farms contiguous suffer in proportion. This depreciation is going on so rapidly that immediate remedial measures are necessary.

"iv. It is in evidence that the probable loss of stock per annum, in consequence of the spread of the 'Prickly Pear,' is 200,000*l*. It is proved that unbroken thickets of this plant furnish shelter for thieving operations to a very serious extent. In these wild animals also find cover and perfect safety from pursuit. We may add that it is proved that an obnoxious intoxicating liquor is largely made from the fruit of the Prickly Pear, which is exercising a very deleterious effect upon the natives.

"v. We are of opinion that it is necessary in the interests of the Colony to grant wise and liberal assistance promptly, in order to eradicate this pest of the 'Prickly Pear' at once. As means to this end we consider it advisable that there should be a special Act providing:—

"(*a.*) That the following districts be proclaimed under this Act, viz., the districts of Graaff-Reinet, Cradock, Somerset East, Bedford, Jansenville, Aberdeen, Willowmore, Uitenhage, and Oudtshoorn, as well as any other districts which may be found necessary.

"(*b.*) That a Commission under the Act be appointed by the Government in each proclaimed district, such Commission to consist of not fewer than five persons, two of whom to be nominated by the Government, one of these two to be the Civil Commissioner of the district, and three persons to be nominated by the Divisional Council.

"(*c.*) The Act to provide for the complete extirpation of the Prickly Pear. In each proclaimed district the Commission appointed to insist under penalties that all land be cleaned. In such cases where proprietors are not able themselves to meet the expenses, the Committee shall investigate and recommend such *pro rata* assistance as they shall deem just. In those cases where a proprietor cannot possibly clean his land, such land to be expropriated, and the fair value decided upon by arbitration to be given to him for it. Then this land to be either cleaned at the expense of the Government, then sold, or sold with a special stipulation that it shall be cleaned immediately by the purchaser.

"We strongly recommend that whatever it may be considered advisable to do be done at once.

"Your Committee have also taken the evidence of the Hon. Mr. Van Rhyn upon the subject of the poisonous plant named 'Melk Bosch,'* which he states is spreading in the Namaqualand and Calvinia districts. we regret that our information is so limited, as to prevent our being able to do more than recommend that the attention of Government be called to the subject, with a view to its being investigated by the Agricultural Department.

"A. Wilmot,
"Chairman."

From the Minutes of the Committee we extract the following, bearing upon the best means to be adopted for getting rid of the Prickly Pear:—

"*Q.* How do you destroy the plant?—*A.* It is first chopped down, we then dig out the stumps, the leaves and stumps are next piled in stacks from fifteen feet to five or six hundred yards long, and 15 to 20 feet in height and diameter, so that they can be easily reached from either side. After remaining in these large heaps for about a year, the outside leaves, which probably have taken root, are taken off and thrown on the top

[* Probably *Gomphocarpus fruticosus*, Br.]

of the stack, and there dried by the wind. In three or four months the whole is dry enough to burn, and the stacks are set on fire. In India they bury the plant after it is chopped down, which is a much better plan, but our Karroo soil is too hard to enable us to carry out this system effectually.

'*Q.* Is there not a particular season when the plant should be cut down, a time when it will decay sooner?—*A.* Winter is the best time, for then the plant is full of sap. The more full of sap the quicker it decays. The latter part of autumn or winter is the proper time.

CLXIV.—JARRAH TIMBER.

(*Eucalyptus marginata*, Sm.)

Of late years a good deal of interest has been attached to the utilisation of the timbers of various species of *Eucalyptus*, several of which have been recommended for use in this country for outdoor work where strength and durability were especially desired. The cost of freight, however, of this heavy timber from Australia (where all the species are native) to England, is one reason why they are not more generally adopted; another reason being their intense hardness, which makes it difficult for ordinary English carpenters' tools to cut or work them. A fresh interest seems to have been awakened in the capabilities of Colonial woods generally by the Colonial and Indian Exhibition of 1886, when the principal woods of each Colony were submitted to tests by Messrs. Ransome and Sons, of Stanley Works, King's Road, Chelsea, and a report by Mr. A. Ransome drawn up and published.*

The species of Eucalyptus to which most attention was drawn in the Exhibition, as structural woods were the Jarrah (*Eucalyptus marginata*, Smith) and the Karri (*Eucalyptus diversicolor*, F. Muell). Fine logs of both were secured for the Royal Gardens, and are now exhibited in Museum No. 3. The former contains 148 cubic feet of timber, and weighs 4 tons 16 cwt. Much more attention has since been given, however, to the development of the Jarrah than the Karri. The tree which produces it grows generally to a height of 100 feet, but sometimes to 150 feet. It is found only in Western Australia, extending over the greater portion of the country from the Moore River to King George's Sound, advancing also to Cape Leeuwin, forming mainly the forests of these tracts. Referring to the wood Baron Mueller says, in his *Report on the Forest Resources of Western Australia*, "The "wood has attained a world-wide celebrity; when especially selected "from hilly localities, cut while the sap is least active, and subsequently "carefully dried it proves impervious to the borings of the *Chelura*, "*Teredo*, and Termites; it is therefore in extensive demand for jetties, "piles, railway sleepers, fence posts, and all kinds of underground struc-"tures, and it is equally important as one of the most durable for the "planking and frames of ships. It is also much used locally for floor-"ing, rafters, spars, and furniture. . . . . It is one of the least "inflammable for building structures, and one of the very best in West "Australia for charcoal." In some notes on the "Forest Resources of

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* Colonial and Indian Exhibition, London, 1886. Reports on the Colonial Sections of the Exhibition, edited by H. Trueman Wood, M.A. Timber (No. 11), by Allen Ransome. London, Clowes and Son, 1887.

Western Australia," circulated in the Colonial and Indian Exhibition of 1886 it was stated that vessels which have been constructed solely of Jarrah have, after 25 years constant service, remained perfectly sound, although not coppered. It has been tried at three places in the Suez Canal, viz., at Suez, Port Said, and Ismailia, and, after having been down seven years, the trial samples were taken up in order that a report on their condition might be forwarded to Paris, and the certificate of the resident engineer pronounced the timber to be practicably indestructible.

The following correspondence on the subject of the application of Jarrah wood for road paving has been received at the Royal Gardens.

No. 1.

The Surveyor, the Vestry of St. Mary, Islington, to Royal Gardens, Kew.

Vestry Hall, Upper Street, Islington,
Dear Sir, March 1, 1889.

The highways committee of this vestry have had their attention drawn to a species of Australian wood known as "Jarrah" timber (*Eucalyptus marginata*), as being highly suitable for the purpose of paving the carriageways of public streets.

As the nature and qualities of this wood are not generally known in this country, and as it has not yet received a thorough trial as a material for paving purposes, and my committee being desirous of laying down a quantity in the streets of this parish, they would be greatly obliged by any information which you could afford them as to whether, in your opinion, the nature of the timber would be likely to be more injuriously affected by the climatic variations of this country than is yellow deal and beech, at present in use as paving, and as to whether it would be likely to withstand the heavy vehicular traffic to which it would be subjected as a metropolitan pavement.

I am informed that a large quantity of this material has been laid down in the streets of Melbourne and is giving every satisfaction.

I am, &c.
(Signed) J. P. Barber,
Surveyor.

No. 2.

The Surveyor, the Vestry of St. Mary, Islington, to Royal Gardens, Kew.

Vestry Hall, Upper Street, N.,
Dear Sir, 7 March 1889.

I have received your letter of the 4th instant containing so much valuable information respecting the Jarrah timber. It is very kind of you to have written me so fully upon the subject and to have pointed out the book upon the gum trees of Australia.

I was perplexed as to what I should do to obtain an opinion about the Jarrah, which seems to be a comparatively unknown and untried wood in this country; but it occurred to me that I might possibly get to know something about it from Kew, although I was not by any means certain that any of the gentlemen there would give information, for I can quite understand that to commence such a practice might be

to throw upon them an enormous amount of work. I therefore feel and appreciate very much your kind and courteous response to my letter.

I will try to avail myself of an early opportunity to examine your collection of timber.

I am, &c.
(Signed) J. P. Barber,
Surveyor.

D. Morris, Esq.

In response to an application to the Surveyor of the St. Martin's-in-the-Fields District Board for a sample block to be placed in the Museum, the following letter was received :—

Vestry Hall, St. Martin's Place, W.C.,
26th September 1889.

Sir,

In reply to yours of the 24th instant, addressed to the Strand District Board, I beg to inform you that the importers of the "Jarrah" wood are Messrs. John Walsh & Co., 81, Gracechurch Street, E.C. I am sending you a sample block for exhibition in the Museum as requested.

I may mention that this wood has already been laid in London, viz., by the Chelsea Vestry in the King's Road, and recently by the Lambeth Vestry in the Westminster Bridge Road.

Yours, &c.
(Signed) Henry Jacques.
Per J. R. S.,
Surveyor.

J. R. Jackson, Esq.,
Curator, Museum,
Royal Gardens, Kew.

CLXV.—TREATMENT OF MILDEW ON VINES.

In the *Kew Bulletin* for September 1889, p. 227, an account is given of the vine industry in the Gironde, with the results of the treatment of diseased vines, with certain remedies. It is there mentioned that the best known remedy against Mildew is the so-called "Bouillie Bordelaise," a mixture of sulphate of copper, slaked lime, and water.

Further, that "the abundance of the 1888 vintage was in a great "measure due to the widespread use of this remedy in the vineyard of "the Gironde."

Under these circumstances it is not surprising to find that the use of "Bouillie Bordelaise" is fast extending to other countries.

The following correspondence on the subject has been communicated to this establishment by the Foreign Office.

Foreign Office to Royal Gardens, Kew.

Foreign Office, 4 August 1890.

Sir,

I am directed by the Marquis of Salisbury to transmit herewith for your information copies of despatches respecting the use of sulphate of copper in dressing vines in France, Italy, and Spain.

I am, &c.
(Signed) James Fergusson.

The Assistant Director,
Royal Gardens, Kew.

No. 1.

Mr. Egerton to Foreign Office.

My Lord, Paris, 22 June 1890.

I have the honour to transmit herewith to your Lordship a report by Sir J. Crowe on the use of sulphate of copper for dressing vines, which he has drawn up for the information of Sir Hussey Vivian, in compliance with the instructions contained in your Lordship's despatch of the 9th instant.

I have, &c.
(Signed) Edw. H. Egerton.

The Marquis of Salisbury, K.G.,
&c. &c. &c.

[Enclosure in No. 1.]

My Lord, Paris, 21 June 1890.

Sir Hussey Vivian asks for information and statistics relative to the use of sulphate of copper for dressing vines in France, and draws attention to the fact that the consumption is becoming large and important, as it is found to be, he believes, the only efficient cure for the phylloxera and other diseases which so seriously affect vines.

The statistics which I have to give show that there is an increasing demand for sulphate of copper for the dressing of vines in France, but that there must be some exaggeration in figures which Sir Hussey Vivian quotes.

According to the returns of the Custom House the quantities of sulphate of copper entered for home consumption in France since 1887 have been as follows:—

1887	kilos	7,736·746
1888	,,	8,818·922
1889	,,	13,524·001

During the first five months of the present year the quantity imported has been as much as kilos 11,214·610 or double the amount imported during the same period of last year.

But sulphate of copper is not used for the purpose of killing phylloxera. The prime remedy for that is sulfuret of carbon; sulphate of copper is good for dressing vines threatened with or suffering from mildew or any other cryptoganic disease.

It is mixed as a powder with common lime and blown with "pulverizators" on to the vine leaves. The name of the mixture is *La bouillie bordelaise;* and it was found to have been a good remedy last year not only where mildew broke out but where an outbreak was expected. But the expense of pulverization is very great in rainy or windy seasons, as the *bouillie* must be renewed whenever the dust has been carried off the vines.

It is difficult to state with any correctness why the imports of sulphate of copper have become so large during the first half of the present year. Price has risen with the increased demand, and yet there is no mildew at present visible in French vineyards.

I am told that the phenomena which are observable at this moment are only to be explained by a large speculative business in sulphate of copper, which is an article that does not lose quality from keeping and which may suddenly be required in large quantities.

I am, &c.
(Signed) J. A. Crowe.

The Rt. Hon. the Earl of Lytton, G.C.B., &c.

No. 2.

The Marquess of Dufferin and Ava to Foreign Office.

My Lord, Rome, 15 June 1890.

I have not failed to apply for the information respecting the use of sulphate of copper in Italy for the prevention and cure of certain diseases connected with vines, as instructed in your Lordship's despatch of the 9th instant, and I shall not fail to forward such information as soon as it shall have reached me.

In the meantime I have the honour to transmit to your Lordship copy and translation of a public notification issued by the Viticultural Society of Italy, pointing out the immense value of sulphate of copper combined with pure sulphur, both in solution and in powder, for arresting various diseases affecting vines and recommending its general use. Further, I enclose, for the information of Sir Hussey Vivian, an abstract of the amount of sulphate of copper imported into Italy during the year 1889 as compared with 1888 and the first few months of the present year, including the price per quintal, and the import duty to which it is subject.

I have, &c.

(Signed) Dufferin and Ava.

The Marquess of Salisbury, K.G.,
&c. &c. &c.

[Enclosure in No. 2.]

Notification issued by the Viticultural Society of Italy respecting the use of Sulphate of Copper in the Treatment of certain Diseases of the Vine.

The *Peronospora* shows itself on the lower side of the vine leaf by white specks like mould. Corresponding to these specks stains appear on the upper side of the leaf, which at first are yellow and afterwards, as the disease progresses, become dark and finally reddish brown.

These stains have no prominences or protuberances. In the contrary case it is a different disease.

The *Peronospora* also appears on the young bunches of grapes, and is distinguishable to the naked eye by the formation of a minute white efflorescence.

The safest and most efficacious remedy to combat it is sulphate of copper or blue vitriol. This remedy can be applied to the vines either in a liquid or a powdered form.

The best remedy in the powdered form is pure sulphur with sulphate of copper: for example, 95 kilos. of pure sulphur to 5 kilos. of sulphate of copper.

The mixture of pure sulphur and sulphate of copper is on sale. It can also be made at home, either dry, by mixing together sulphur and sulphate of copper, or wet, by dissolving sulphate of copper in warm water, and then sprinkling this liquid on the sulphur, and, after mixing it well, drying it and passing it through a sieve.

In dealing with pure sulphur this second method is preferable.

The mixture of sulphur and sulphate of copper should be applied to all the green parts of the vine with common bellows. It must be remembered, however, that the powders are always less effectual than the liquid solution.

The liquid solution is the most drastic, most economical, and safest remedy against the *Peronospora*, and should be preferred in localities which are severely attacked.

This solution is prepared in the following manner to the proportion of 100 litres of water. Put in a wooden barrel 100 litres of water, and mix with it one kilo. of slack lime; mix it well and let it settle. Add to the water, which has thus been made milky in colour, one kilo. of sulphate of copper which has been dissolved in four or five litres of warm water. It is of practical utility to put lime in the water, and to give the emulsion a whitey colour, in order that the workmen may at once perceive to what parts of the vine it has been applied.

The liquid solution can be efficaciously given with a pumping machine furnished with pulverizers (? roses) which make a great economy of liquid. In case of urgency in the absence of an apparatus anything will do, even a whitewashing brush.

The mixed system has been very much recommended, that is, alternating the liquid and dry treatments.

Thus, in the beginning of May the sulphur with sulphate of copper should be given as much as a preventative against *Oidium* as against *Peronospora*, and in the middle of May should follow the first treatment with liquid. In the first days of June there should be another application of sulphur and sulphate of copper, and in the middle of June another treatment with liquid.

At this season anyone who has neglected the above should no longer delay to apply the liquid treatment, and in the first half of July that with sulphur and sulphate of copper, and then in the first half of August another liquid dressing.

Another liquid application can be given, when required, towards the end of August.

In order to be quite sure of contending successfully with the *Peronospora* it is necessary that each application should be preventative, that is, it should be made before the disease attacks the vine.

The treatment should be repeated if rain storms nullify the effect.

It has now been proved that sprinkling with sulphate of copper preserves the vines from other fungi and parasitic insects such as the different "rots":—Anthracnose, Chlorosis, and at least to some extent from *Rhynchites* and *Tortrix*.

[Enclosure in No. 2.]

TABLE showing importation of Sulphate of Copper, Zinc, &c., into Italy during the years 1888 and 1889.

——	Weight. (Quintals.)		Value. (Francs.)		Average Price. (Francs.)	
	1888.	1889.	1888.	1889.	1888.	1889.
Sulphate of copper, zinc, &c.	14,815	34,108	814,825	2,046,480	55	60

The importation during the four months, from 1st January to 30th April 1890, consisted of 34,600 quintals of the value of fcs. 2,076,000. The import duty is fcs. 2 per quintal.

No. 3.

The Marquess of Dufferin and Ava to Foreign Office.

My Lord, Rome, 25th July 1890.

With reference to my despatch of the 15th ultimo, I have the honour to transmit to your Lordship herewith translation of a note which I have received from the Italian Government giving statistics of the importation of Sulphate of Copper into this country. The amount imported is, as your Lordship will perceive, rapidly increasing.

I have, &c.

(Signed) Dufferin and Ava.

The Marquess of Salisbury, K.G.,
&c. &c. &c.

[Enclosure in No. 3.]

From the Italian Minister of Agriculture and Commerce to the Marquess of Dufferin and Ava.

Rome, 23rd July 1890.

The Customs denomination No. 43 d. includes, besides Sulphate of Copper, Sulphate of Zinc, and Double Sulphate of Copper and of Iron. As the former of these has, from a commercial point of view, a greater importance than the latter two, and as no new industrial application has caused an increase in the demand of sulphate of zinc and of double sulphate of copper and of iron, we may consider according to what the Custom House authorities of the Kingdom declare the importation recorded on the statistical returns under No. 43 of the Customs Tariff consists almost exclusively of sulphate of copper.

Your Excellency will find the returns of the exportation and importation of sulphate of copper during the years 1887, 1888, 1889, and during the four months of the current year (1890) in the ensuing table. [*See* Enclosure to No. 2, p. 193.]

As I have already remarked, the importation and exportation of the said salts consist almost exclusively of Sulphate of Copper. As regards the importation it is almost *nil*, and if we except the increase noted in the returns for April last we find that exportation has gone gradually diminishing during the last three years.

In 1888 importation pointed out a slight increase, during last year it more than doubled itself, and during the first months of 1890 the returns show that the increase continues. There is reason to believe that the returns for May and June last, which are not yet published, will give the same results. The increase is so very notable that during the first four months only of the year 1890 about 400 quintals were imported more than the quantity imported in the year 1889, notwithstanding that in 1889 importation was more than double as compared with the preceding year.

No. 4.

The Hon. W. A. C. Barrington to Foreign Office.

My Lord, Madrid, 14th July 1890.

On receipt of your Lordship's despatch of the 9th ultimo I made some inquiries about the employment of Sulphate of Copper for dressing vines in Spain, but it does not appear that this mode of treatment is extensively applied.

Where used Sulphate of Copper has not been adopted as a cure for Phylloxera but as a preventative of mildew and "rot," for which purpose it has no doubt been shown to be efficacious, although even when

steps have been taken to encourage its use by vine-growers the latter have not shown much alacrity in availing themselves of the facilities placed at their disposal. Thus I am told by the Director-General of Agriculture here that were this substance to be generally used in the vine districts of Catalonia, Valencia, Aragon, and Old Castille its consumption in moist years would amount to some 2,000 tons (2,000,000 kilograms), yet when the authorities offered to supply growers in the first-named province at specially favourable rates, the applications made in response to the proposals were for an amount which only reached about 45 tons. It is possible that mistrust of the official offer may have caused cultivators to obtain such supplies as they needed through other channels, but it is difficult to arrive at any sound conclusion by referring to Custom House returns, as at Barcelona all such imports from England are entered under the one head of "Chemical Products."

From the south-eastern districts I have as yet failed to ascertain any particulars, but as regards Aragon, Navarre, Old Castille, and for a small quantity Biscay also, Bilbao would probably be the port of entry, and the amount of Sulphate of Copper imported there last year from the United Kingdom was about 500 tons.

In the neighbourhood of Lenares there is no disease, neither is there any demand at all for the preventive in question in the Val de Peñas and Villacañas districts, whilst at Cadiz the importation only consisted of some 23 tons last year, very little being wanted, there being no disease to speak of in the vineyards of Jerez, where the insignificant consumption has been of an experimental nature. Indeed, I hear from there that though the regular retail price of Sulphate of Copper is 30*l.* per ton it has been offered at from 24*l.* to 25*l.* without being taken up by the growers.

As I had the honour to inform your Lordship in my despatch of the 2nd instant, Sulphate of Copper is now admitted into Spain free of duty.

I have, &c.

(Signed) William A. C. Barrington.

The Marquess of Salisbury, K.G.,
&c. &c. &c.

CLXVI.—CULTURAL INDUSTRIES IN WEST AFRICA.

Our possessions on the West Coast of Africa, consisting of the Gambia, Sierra Leone, Gold Coast, and Lagos, occupy, for the most part, narrow strips of country parallel to the sea coast, and extend to no great distance inland, except along the banks of a few of the principal rivers. The circumstances of these possessions and their relations to the natives in possession of the high lands in the interior have hitherto prevented attention being devoted to any agricultural pursuits of a settled character.

Both the European and native communities have so far directed all their energies to the development of trade in such commodities as are brought to them from the interior. These commodities, with the exception of some gold and ivory, are mainly the natural products of the forest, such as have required little at the hand of man except the trouble of collecting and conveying them to the coast. There are, it is true, a few native agricultural industries carried on in a crude manner, such as ground nut, cotton, and the raising of corn, yams, and vegetables. The value and extent of these would appear at present to be very small. Owing, however, to the depreciation in the value of ground nuts, palm oil, and

palm kernels, which have hitherto formed the staple exports of West Africa, a change is gradually taking place in the sentiments and feelings of the natives, and a desire, wisely fostered by the intelligent policy pursued by the local Governments, is expressed in favour of giving more attention to the systematic cultivation of the soil. Botanical stations have recently been established at Lagos and the Gold Coast for the propagation and experimental cultivation of industrial plants, and, as shown in the *Kew Bulletin*, considerable interest has been taken at Kew in the development of numerous plant products which have been sent to this country from West Africa for valuation and report. The present Governors of our West African possessions are keenly alive to the desirability of directing attention to the development of agricultural industries, and at no time, possibly, in recent years have these possessions received more attention in this country than at present. For this awakened interest we are indebted to Sir Alfred Moloney, K.C.M.G., Governor of Lagos; Sir W. Brandford Griffith, K.C.M.G., Governor of the Gold Coast; Sir James Shaw Hay, K.C.M.G., Governor of Sierra Leone; and Mr. T. Gilbert Carter, C.M.G., Administrator of the Gambia. These officers, it is needless to say, have fully realised the importance of encouraging agricultural enterprises, and taken a leading part in the steps necessary for directing attention to them.

Sir Alfred Moloney published in 1887 a "Sketch of the Forestry of "West Africa, with particular reference to its Principal Commercial "Products." In this work all available information has been brought together respecting plants yielding oils, gums, rubbers, coffee, cacao, medicinal substances, spices, and many others.

As an additional sign of the times, it may be mentioned that a small work has recently been published in this country by a native of Sierra Leone under the title of a "Manual on the Cultivation and Preparation "for Export of some of the Commercial Products indigenous and "exotic in Sierra Leone." A youth from the same Colony has just carried off a prize at one of our agricultural colleges; and we may add that Governor Moloney has a scheme under consideration for sending some native youths from Lagos to be trained at Jamaica in the culture of economic plants suited for West Africa.

As frequent inquiry is made at Kew in regard to plants likely to flourish in West Africa, the following Memorandum, prepared, in the first instance, for the Royal Niger Company, is now published in an expanded form for the information of those interested in our West African possessions:—

Memorandum on the Experimental Cultivation of Economic Plants in West Africa.

Experimental plantations in West Africa, where systematic cultivation has not yet been carried on, to show what is really suitable to the soil and climate, should include at first a large number of economic plants, for the purpose of testing those which afford the best prospect of being adapted to local circumstances. The reports which have already reached Kew from this region, and especially from the botanical stations at Lagos, the Gold Coast, and the Gambia, show that many useful plants could be grown there. These centres will in time be in a position to select a few of the most promising plants, and distribute them for extended culture in different portions of their respective Colonies. Many of the ordinary tropical plants requiring a damp, humid atmosphere all the year round and entire freedom from droughts are evidently not suited to many parts of West Africa. The prolonged drought

experienced during several months of the year, often accompanied by very dry winds, would be fatal to the remunerative culture of such plants.

It is evident, however, that if it were possible to plant large areas with a few select plants, such as Liberian coffee, fibre plants, Egyptian cotton, cardamoms, ginger, indigo, black pepper, and other similar plants yielding raw material in large commercial demand in this country, there would be a fair prospect of the results being eminently satisfactory. The plants mentioned above may be regarded as in many ways suited to the soil and climate of West Africa, and the number could be yearly increased as the results of the cultivation in the experimental plantations are more fully known.

If any of the Colonies possess stretches of sandy coast land, it might be taken up for the planting of Cocoa-nut palms. The Cocoa-nut thrives in deep, sandy soils near the sea, and already the plantations established in various parts of West Africa show that this valuable plant could be grown upon a large scale most successfully and profitably. It is true it takes a long time to come into bearing. On the other hand, the fruit is always in demand, either fresh, made into oil, or prepared in various ways, such as "copra," to suit the markets of the world. Recently an industry has arisen in Germany to prepare a very palatable butter from the kernel of the Cocoa-nut. The process so far is entirely in the hands of a private firm (Messrs. Müller and Sons, of Mannheim, Baden), but if the industry is extended, it will undoubtedly increase the demand for fresh nuts in European markets. Cocoa-nut coir, the fibre prepared from the husk of the Cocoa-nut, is an article extensively used for manufacturing purposes in Europe. Coir prepared experimentally at Lagos under the direction of Sir Alfred Moloney was lately valued in London, and proved of good quality. Particulars in regard to the requirements of the London market for Cocoa-nut coir are given in the *Kew Bulletin* for June 1889, pp. 129–132.

Egyptian cotton is just now attracting attention. When the staple is long it fetches a high price. It might be tried in West Africa on a large scale, and with this view it would be desirable to obtain seed direct from Egypt. Full information respecting West African cotton and its value in the English market is given in the *Kew Bulletin* for June last, p. 135.

Coffee of both sorts, Arabian and Liberian, should be cultivated on a large scale in every West African Colony. The Liberian coffee grows freely at almost sea level while the Arabian coffee will flourish on any of the hills in the interior. Now coffee production in the East Indies is so greatly reduced on account of the leaf disease, there is likely to be a large demand for this important food product at remunerative prices. Where any difficulty exists in pulping and curing coffee it might be shipped to this country in "cracked" state, that is, in a thoroughly dry condition after being directly gathered from the trees. Information on this subject is given in the *Kew Bulletin* for May 1888, pp. 129–132; and November 1888, pp. 261–263.

Of fibre plants there are several that are adapted to West Africa. Already the Bowstring Hemp yielded by one or more species of *Sansevieria* has been successfully prepared at Lagos, and the market value of the fibre has shown it to be of high quality. To establish an industry in bowstring hemp it would be necessary to plant at least 200 or 300 acres before steps should be taken to introduce machinery to clean the fibre. The Death Fibre Machine Company, of 147, Leadenhall Street, E.C. might be in a position to supply particulars

as to the success of growing bowstring hemp in Cuba and also as to the best machines for preparing the fibre.

The Sisal Hemp plant, *Agave rigida*, var. *Sisalana*, could very easily be introduced to West Africa. Small plants, in quantity, are probably obtainable from Florida. The Sisal Hemp would grow in dry, arid, districts unsuited to almost any other plants. If 500 plants were introduced at first, these after two or three years would yield sufficient suckers to establish several acres. The Ramie or China grass plant may be regarded as unsuited to West African enterprise at present, and it would be useless to devote attention to it unless there is a sufficient supply of labour to work large plantations and suitable machinery is obtainable to decorticate the fibre at a low cost.

Of the jute class of fibre plants there are two very valuable fibre plants already abundant in West Africa. These are the "Bolobolo" (*Honckenya ficifolia*), fully discussed in the *Kew Bulletin* for January 1889, and the Toja (*Urena lobata*). The fibres of these plants are probably worth 18*l.* to 20*l.* per ton, and the price is always likely to be maintained at such a figure as would render a jute industry remunerative. It might be possible to get the natives to clean these fibres by hand and sell the produce in small lots locally.

Amongst plants usually cultivated in tropical countries and already under experimental trial in some parts of West Africa are the Annatto (*Bixa Orellana*), Cassava (*Manihot Aipi*), Arrowroot (*Maranta Arundinacea*), Vanilla (*Vanilla planifolia*), and Pimento or Allspice (*Pimenta officinalis*). These do not appear to yield remunerative results at present. They are, however, well worthy of attention, and especially if the natives can be induced to grow any of them. Annatto seeds are now sold at prices that cannot pay expenses. It might, however, be a matter for consideration whether the colouring matter could be manufactured into what is known as Annatto roll, cake, or paste. These could be easily prepared as indicated in the *Kew Bulletin* for July 1888. For paste or cake there is a more steady and satisfactory demand than for seeds. Indigo, as is well known, requires a special system of cultivation and manipulation, and if taken up at all it must be on a large scale. The Yoruba Indigo yielded by *Lonchocarpus cyanescens*, Benth., is described in the *Kew Bulletin* for November 1888, p. 268, with a figure of the plant. Yoruba Indigo sent to Kew by Sir Alfred Moloney was valued in 1883 at 4*s.* to 4*s.* 6*d.* per pound. It is possible that this sort might be more successful in West Africa than the ordinary indigo. The natives are accustomed to the preparation of it, and it is only necessary to eliminate the earthy matter and portions of the stems usually found in Yoruba Indigo to produce samples worth nearly as much as the best Bengal Indigo.

Vanilla and Pimento are valuable spices, but probably not everywhere suited to the soil and climate of West Africa. They might, however, flourish inland where it is damper and moister, and it would be well on this account to keep them under observation and increase the stock in view of future action.

It is a little doubtful whether the Cacao or Chocolate will eventually justify the hopes at present entertained respecting it. Although the plants survive the dry seasons it is possible that they may not ultimately yield remunerative crops. On the other hand, in sheltered valleys inland and in damp localities free from prolonged droughts Cacao should do very well. Next to Coffee, fibres, Egyptian cotton, and spices, I would regard Cacao or Chocolate as a most promising and reliable industry for West Africa if only the right soil and climate are found for

it. Tea may be tried and also Tobacco, but unless an expert is engaged to grow and prepare the produce there is no hope of establishing a permanent industry to supply European markets with either of these at present.

It may be very well worth while to try and establish the Ceara Rubber (*Manihot Glaziovii*) in West Africa. It has apparently established itself at the Gambia in very poor sandy soil and under very arid conditions. It requires little attention and yields rubber at an early period. It very much resembles the Cassava plant in habit and requirements, and as the natives already cultivate the latter they would be likely to take very readily to the rubber plant. Seed of the Ceara rubber could be obtained in quantities from Ceylon.

The cultivation of fruits in West Africa might be greatly extended, if only for local demands. Pine apples, bananas, guavas, oranges, limes, mangoes, bread-fruit, custard apple, avocado pear, tamarind, granadilla, papaw, water melons, are already found growing at or near most of the Settlements. Little or no attention is, however, devoted to their systematic culture, and hence the yield and quality are below what they ought to be. It may be found ultimately practicable to export some of the fruits in a fresh or preserved state to this country. An account of West African fruits and the production of each at Sierra Leone, Gold Coast, and Lagos is given in the *Kew Bulletin* for October 1888, pp. 221–224.

In reports which have reached Kew from West Africa considerable stress is laid upon the difficulty of keeping plants alive during the dry season. It is evident that a continuous supply of fresh water, easily accessible to nurseries and plantations, is of the highest importance. Water should be abundantly provided by means of small irrigation channels all over plantations in dry districts, with holes or wells here and there to facilitate watering any plants that require it. The saving in labour under such circumstances would be very considerable. Shelter trees should be planted, where they do not already exist, to protect the plantations from winds and to shade such plants as require it from the direct rays of the sun.

There are several species of figs in West Africa that are admirably adapted to this purpose. Live fences made of such plants as logwood and the Madras thorn (*Inga dulcis*) would protect the plantations and afford some relief from dry winds. The logwood is a tree of great promise for West Africa. Seeds of logwood could easily be obtained from the West Indies, while seeds of the Madras thorn might be got from Ceylon or India.

The question of soil should receive the most careful attention. A rich loamy soil of good depth, with good natural drainage and within easy reach of water, is most essential for cultivated areas. There should be considerable time spent over the selection of sites for plantations, and every point should be carefully considered before the site is ultimately settled.

(Signed) D. Morris.

CLXVII.—ECONOMIC PLANTS OF MADAGASCAR.

In a valuable paper by the Rev. Richard Baron, F.L.S, on the Flora of Madagascar (*Journ. Linn. Soc.*, vol. xxv., pp. 246–294), it is stated that the "vegetable productions of Madagascar have been very extensively "explored, and that the majority of the plants inhabiting the island are "known to science." The flora of the low-lands of the southern part of the island is still, however, the least known. Our knowledge of the flora of Madagascar is due to the labours of numerous botanists from Flacourt, Dupetit Thouars, and Commerson to Grevé, Bojer, Grandidier, and Ellis. Within the last few years this knowledge has been greatly increased through the very successful labours of Mr. Baron himself, and his collections, received at Kew, have been determined and described by Mr. J. G. Baker, F.R.S. It is estimated that whereas until recently less than 2,000 species of plants were known from Madagascar, there are now named and described about 4,100 species.

Mr. Baron has been good enough to supplement his paper on the Flora of Madagascar by preparing for the *Kew Bulletin* some brief but interesting notes on the economic plants of the island. These plants are of considerable interest and importance. One of the earliest notices of Madagascar economic plants is contained in Rochon's *Voyage to Madagascar and the East Indies* (English translation, 1793, pp. 280–297). In this work plants from the north of Madagascar, "now trans-"planted in the Royal Botanical Garden at the Isle de France" (Mauritius), are given under their native names. The Ravensara (*Ravansara aromatica*), the Tanguem or Tangèna (*Tanghinia venenifera*) and the Filao (a species of *Casuarina*) and many others are noticed. The latter tree is quaintly and not unappropriately described as "Equisetum arborescens."

Dr. G. W. Parker, a medical missionary sent out to Madagascar, has recently prepared a Malagasy Materia Medica, with special reference to the use of native plants. This, with determinations made at Kew, was communicated to the *Pharmaceutical Journal*, 1881, vol. xi., pp. 853–855.

There are numerous scattered notes respecting the economic plants of Madagascar to be found in other works, but the above appear to include the more systematic attempts to describe them. It may not be inappropriate to mention here that there are still some very valuable plants of Madagascar about which at present we know very little. As shown in the *Kew Bulletin* for May 1888, p. 135, we are not acquainted with the source of Madagascar Ebony nor of Madagascar Sandal wood. There is also the plant which yields Madagascar Piassava. This is doubtless a palm, but not a species of Raphia as is generally supposed.

The publication of Mr. Baron's notes will serve a useful purpose if they do no more than stimulate others to follow his example and treat of plants growing beyond the special districts covered by his investigations.

In order to give a general idea of the character of the Madagascar flora and the regions adopted in Mr. Baron's notes the following extracts are taken from his paper published by the Linnean Society.

"In Madagascar a considerable area is covered by primeval forest. On the eastern side of the island (that is, the part eastward of the highest range of mountains which forms the chief watershed) there is a forest which extends probably 800 miles from north to south, almost, if not entirely, without a break, and which, if what is frequently stated

be true, continues round the island, forming a complete, or almost complete, belt some distance from the sea. Whether the forest does thus actually encircle the island is somewhat questionable. There can, however, be no doubt that in the western part of Madagascar there are forests, mostly, I believe, narrow, which run for long distances in a northerly and southerly direction, but how far these are continuous is not yet known. In regard to the large eastern forest, it attains its greatest dimensions in the north-east part of the country. Here it reaches in many places from the mountains of the interior right down to the sea, and is probably 60 (in North Antsihanaka perhaps 80) miles in width. If we take its average width on the eastern side of the island at 30 miles, and its length at 800, we get an area of 24,000 square miles of forest-clad country, not reckoning the innumerable patches of wood on the lower slopes. If we include these, probably two-fifths, if not one-half, of the eastern side of the island is clothed with trees. In the whole of Madagascar, if one may be allowed to make a rough estimate, there will not unlikely be an area of 30,000 square miles of forest-covered country; and if we reckon the area of the island at 228,000 square miles, about one-eighth part of it may be said to be so covered."

* * * * *

"I have long been convinced that the flora of Madagascar may be divided into three regions, and the data given below will, I think, justify the conviction. These regions run in a longitudinal direction, following approximately the longer axis of the island. I propose to call them eastern, central, and western. The central region includes the elevated plateau of the interior, that is to say the territory bounded on the east by the western edge of the great forest, on the west by the high land, from which there is generally a more or less distinct descent into the western lowlands, on the north by lat. 14°, and on the south by the tropic of Capricorn. Its limits may be more definitely traced thus:— From the tropic of Capricorn and long. 46° 50′ the line runs about 15 miles east of Ihosy, thence to Ikalamavony, passes a few miles to the east of Ankavandra, turns north-east to Malatsy and Antongodrahoja, on to Isomboana, follows the range of mountains in the province of Befandriana, then up to a point half-way across the island in lat. 14°; coming south, it skirts the great forest until it reaches the mountain of Ambiniviny, it then takes a direction a little west of south until it again reaches the forest to the west of Ambatondrazaka (thus shutting out the great Antsihanaka province), which it skirts until it meets the tropic at Capricorn. By connecting the northern point with Port Lonky (or Loquez), and the southern point with the mouth of the River Andrahona, the divisions will be complete. All the territory to the west of the limits thus defined, with the island of Nosibé and all others near the mainland, constitute the western region, and that to the east the eastern. Of course it is not pretended that these regions can be defined with great accuracy, the divisions in the extreme north and south of the island, between the eastern and western regions, where they come in contact, being almost arbitrary. To what points north and south the central region should extend is also somewhat uncertain. The limits, however, of the three divisions, as thus defined, may be accepted as substantially correct. Inasmuch as these regions range through about thirteen degrees of latitude (the eastern and western regions being chiefly, and the central entirely, within the tropics), there

must necessarily be considerable variation in the character of the vegetation in a northerly and southerly direction, but the variation is gradual and by no means so marked or distinct as it is in an easterly and westerly direction."

* * * * *

"In the eastern region the two most abundantly represented orders are *Filices* and *Compositæ;* but the former are more than double the latter in the number of species, forming respectively 13·1 and 6 per cent. of the flora of this region. It will be noticed that Filices do not appear in the second or third column at all, the reason being that I have not sufficient data for determining their relative positions. Possibly they might occupy the third or fourth place. In the western region the *Leguminosæ* stand at the head of the list, and these are followed by *Euphorbiaceæ;* but the difference between the two is very great, the proportion being about 5 to 2. The table shows that 18·8 per cent. of the flora of the western region consists of *Leguminosæ*. The *Compositæ* appear to be poorly represented, forming only 3·2 per cent. of the flora. In the central region, on the other hand, the *Compositæ* are at the head of the list, with a per-centage of 13. *Rubiaceæ*, again, which one might expect to be largely represented in the western region, only form 3·2 per cent. of the flora. The eastern, central, and western regions, therefore, might, if we take the most largely represented orders into account, be fairly called the Fern region, the Composite region, and the Leguminous region respectively."

* * * * *

"That the flora of the central region should differ widely from the flora of the eastern and western regions is accounted for by the great elevation above the sea of the central part of the island. But how are we to explain the existence of so great a difference between the floras of the eastern and western regions, occupying, as they do, the same latitudinal and altitudinal positions, for of the 2,206 plants found in the eastern and western regions only 128 (not reckoning the 100 occurring in all the three regions) are common to both. I believe the explanation to be simple. The central elevated plateau of the island, which runs from north to south, is undoubtedly of very great antiquity, having existed not improbably from Palæozoic times, and has therefore always formed a barrier between the floras of the eastern and western regions. The floras therefore, even if they were formerly similar, which is doubtful, have had abundance of time to become differentiated in character; and if they were originally different, they have been kept, by the existence of the mountain barrier, distinct to the present day."

NOTES ON THE ECONOMIC PLANTS OF MADAGASCAR, BY THE REV. R. BARON, F.L.S.

Guttiferæ.

1. *Symphonia clusioides*, Baker, and other species of *Symphonia*. The wood of these trees is used for various purposes, as is also the gamboge-like resin which they yield. (Forests of E. Reg.) *Dintìnina*, *Ràmy*, and *Haràmy*.

An allied tree (*S. globulifera*, L.) native of Jamaica and British Guiana, yields from its roots a quantity of resin, used in medicine and for fixing arrowheads to spears. It is known in Jamaica as Hog Gum and in British Guiana as Karamani Resin.

2. *Garcinia mellifera*, Baker, and *G. pauciflora*, Baker. (E. Reg.) These are near allies of the tree which yields the celebrated Mangosteen (*G. Mangostana*, L.) of the Malay Archipelago and also of the Siam and Ceylon Gamboge trees. (*G. Hanburyi*, Hook. f., and *G. Morella*, Desr.)

3. *G. Gerrardi*, Harv. A tree with edible fruit. Probably introduced. (Cent. Reg.)

4. *Calophyllum Inophyllum*, L. (E. Coast.) *Foràha* (Betsim). A large evergreen tree of India, Burma, Andaman Islands, &c. The wood is hard and durable, and the seeds yield a thick dark green oil.

5. *C. parviflorum*, Boj. A tree affording a useful wood. (Upper Forests of E. Reg.) *Vintánina*.

Chlænaceæ.

6. *Leptolæna pauciflora*, Baker. A hard-wooded tree used in house-building. (Forests of E. Reg.) *Anjanànjana*.

7. *Xerochlamys pilosa*, Baker. Used in the manufacture of rum. (Central Madagascar.) *Hatsìkana*.

8. *Rhodolæna bakeriana*, Baill., and *Leptolæna turbinata*, Baker. Woods used in house building. (E. Reg.) *Fòtona*.

Malvaceæ.

9. *Abutilon angulatum*, Mast. A shrub, probably introduced, from the fibre of the bark of which the Betsiles manufacture a kind of cloth. (Cent. and E. Reg.) *Hàfopòtsy*.

10. *Pavonia Bojeri*, Baker. A shrub yielding a kind of fibre. (Cent. Reg. chiefly.) *Tsòntsona*.

11. *Hibiscus tiliaceus*, L. (E. and N.W. Coasts.) *Vàro* and *Bàro* (Betsim).

12. *Adansonia madagascariensis*, Baill. The Madagascar Baobab. Its bark affords a fibre and its fruit is edible. (W. Coast.) *Bontòna; Za* (Sak.). Two other species only are known, viz., the Baobab or Monkey-bread tree of W. Africa (*Adansonia digitata*, L.), the pulp

of the fruit of which is edible and the bark fibrous, and the Australian Gouty Stem tree (*A. Gregorii*, F. Muell.), the pulp of the fruit of which is also eaten by the aborigines.

13. *Eriodendron anfractuosum*, D.C. The silk cotton surrounding the seeds is used for stuffing cushions, but is said to be dangerous to the eyes. (W. Reg.) *Moraingy* and *Hàmba* (Sak.). This plant has a wide distribution in the tropics of the Old and New Worlds, and the silk cotton, under the name of Kapok, is exported from Java to Europe and Australia for stuffing mattresses.

Sterculiaceæ.

14. *Dombeya, spp.* Small trees whose bark supplies a useful fibre largely used by the people. (Cent. and E. Regs., especially forests.) *Hàfotra.* [This was, no doubt, the fibre about which a somewhat lengthened correspondence took place with the Foreign Office in 1881. It was carefully studied by the Leeds and Dundee Chambers of Commerce, and was reported to be, while destitute of textile value, well fitted for paper-making. It, in fact, closely resembled the bark of *Broussonetia papyrifera.*]

Tiliaceæ.

15. *Grewia macrophylla*, Baker. A shrub from which the Sihanaka obtain a kind of fire. There are 45 species of *Grewia* known in the island, chiefly in the W. Reg., many of which yield a useful fibre. *Màkolòdy* (Antsih).

16. *Corchorus olitorius*, L. One of the plants which yield the valuable fibre obtained from India known as Jute. (E. and W. Regs.)

17. *Elæocarpus, spp.* Trees, nearly all of which yield useful timber employed in house building. *Vànana* or *Voànana.*

Lineæ.

18. *Erythroxylon myrtoides*, Bojer. A shrub with black wood, employed chiefly in ornamental work. (Cent. and E. Regs.) *Hazomainty.* This is an ally of the well known coca plant of Peru. (*E. Coca*, Lam.)

Ochnaceæ.

19. *Ochna, sp.* A hard-wooded tree. *Ràngа* or *Ràngy.*

Celastrineæ.

20. *Elæodendron lycioides*, Baker. A shrub used by the Sakalava in reddening their finger nails. (W. Reg.) *Mòina* (Sak.).

21. *Elæodendron, spp.* One or more species with light coloured wood is used for the poles of gentlemen's palanquins, &c. (Forests of E. Reg.) *Hàzondràno.*

22. *Salacia dentata*, Baker. A shrub or tree? possessing an excellent fruit. (Forests of E. Reg.) *Tsìmatra* or *Voàntsìmatra.*

Anacardiaceæ.

23. *Rhus* (*Baronia*) *Taratana*, Baker. A hard-wooded tree. (Cent. and E. Regs.) *Màroavòlona Vorètra* or *Taràtana*.

24. *Spondias dulcis*, Forst. Probably introduced. It has an edible fruit known in India as Hog-plum and Otaheite apple. *Sakòana*.

25. *Sclerocarya caffra*, Sond. A small tree, yielding an acrid, edible fruit, about the size of an apple. (W. Reg.) *Sakòana*.

Connaraceæ.

26. *Rourea platysepala*, Baker. A tree with edible fruits. *Vòampìka* (Ank.).

27. *Cnestis polyphylla*, Lam. Used as a dog poison. (E. Reg.) *Vòasèfaka* or *Vasèfaka* (Betsim).

Leguminosæ.

28. *Crotalaria striata*, D.C. Used as a black dye for Rofia cloth. (E. and Cent. Regs.) *Bèravimpòtsy*. This is a close ally to the Sunn Hemp of India, which is furnished by *C. juncea*, L.

29. *Indigofera pedunculata*, Bojer. Affords a kind of dye, *Aikamànga*. The well-known indigo of commerce is furnished by *Indigofera Anil*, L., and *I. tinctoria*, L., and probably other species, which are cultivated to a very large extent in India, Central America, W. Indies, &c.

30. *Herminiera Elaphroxylon*, G. and P. A shrub with wood, almost as light as cork. It is the Ambash or Pith tree of the Nile, where the natives use it to assist them in swimming across the river. Colonel Grant says:—"It grows so rapidly that in three years it almost choked up the channel of the Bahr el Gazelle." (Marshy land in Antsih.) *Odifònga*.

31. *Dalbergia Baroni*, Baker. A large tree with valuable wood; used for furniture, &c. (Forests of E. Reg.) *Vòambòana*.

32. *D. trichocarpa*, Baker, and, probably, also one or two other species of *Dalbergia*. Shrubs or trees possessing useful wood used in house building. The one known as *Manàrilàhy* has a very durable reddish wood; the wood of *Manàrivàvy* is somewhat lighter in colour. (W. Reg.) *Manàry* (Sak.).

33. *Neobaronia phyllanthoides*, Baker, and *N. xiphoclada*, Baker. The wood, which is extremely hard, is used for spade handles, &c. (The former is found in the forests of the E. Reg.; the latter occurs in the Cent. Reg.) *Hàrahàra*.

34. *Tamarindus indica*, L. The Tamarind, the pulp of the pods of which, preserved in sugar, is imported into Europe from India and the W. Indian Islands. (W. Reg.) *Madìlo* or *Kìly*.

35. *Trachylobium verrucosum*, L. The Gum Copal tree of Madagascar. It yields a hard resin similar to Anime. (E. Coast.) *Tàndroròho* (Betsim).

36. *Piptadenia chrysostachys*, Benth. The wood of this small tree is said to be used for certain musical instruments. (Cent. and E. Regs.) *Fàno.*

37. *Albizzia fastigiata*, Oliv. A tree with dark wood used in dyeing. (Widely spread in the island.) *Vòlombòrona.*

SAXIFRAGEÆ.

38. *Weinmannia, spp.* Various species of *Weinmannia* afford wood commonly used in house building. (Chiefly forests of E. Reg.) *Lalòna.*

39. *W. Rutenbergii*, Engl. A shrub (or tree?) with very durable wood. (Upper forests of E. Reg.) *Hàzomèna.*

HAMAMELIDEÆ.

40. *Dicoryphe, sp.* A hard-wooded tree. (Cent. Reg.?) *Maintipòtotra.*

41. *D. viticoides*, Baker. A tree affording useful wood. (Forest on Ankaratra.) *Tsitsìhina.*

RHIZOPHOREÆ.

42. *Weihea sessiliflora*, Baker. A shrub (or tree?) whose bark is said to taste like cinnamon. (E. Antsih.) *Hàzomàmy* (Antsih).

COMBRETACEÆ.

43. *Combretum coccineum*, Lam. A climbing shrub yielding a fibre. (W. Cent., and E. Regs.) *Salay.*

MELASTOMACEÆ.

44. *Dionychia Bojeri*, Naud. A shrub or small tree affording a black dye used for silk. (Cent. Reg. chiefly.) *Bòngo.*

SAMYDACEÆ.

45. *Casearia lucida*, Tul. The wood is employed for making drums. (Cent. Reg.) *Hàzomalèfaka.*

ARALIACEÆ.

46. *Cuphocarpus inermis*, Baker. And probably other allied shrubs, used in making musical instruments. (E. Reg.) *Tsiènimpòsa.*

47. *Panax, spp.*, and *Cussonia, spp.* Employed in house building. (Forests of E. Reg.) *Vàntsìlana.*

RUBIACEÆ.

48. *Cephalanthus spathelliferus*, Baker. A tree used in house building. (River sides of West Cent. Reg. and W. Reg.) *Sohìhy* and *Sòdindrànto.*

49. *Schismatoclada, spp.* Shrubs (or trees?) closely allied to Cinchona. (Forest of E. Reg.) [An examination made for Kew by the late J. E. Howard, F.R.S., failed to detect any trace of Quinine in the bark.]

50. *Danais Gerrardi*, Baker. A climbing plant from the root of which the Sihanaka obtain a kind of dye and from whose bark they obtain a kind of fibre. (Forests of E. Reg.) *Haizantolòho* (Antsih).

51. *Urophyllum Lyallii*, Baker. The bark is said to be used in the manufacture of rum. (Forests of E. Reg.) *Fatray.*

52. *Gardenia succosa*, Baker. A shrub from which exudes a kind of gum. (W. Reg.) *Amòkombè* (Sak.).

53. *Guettarda speciosa*, L. A tree which affords the wood known as Zebra wood. (E. and W. Coasts.) *Tambàribarìsa* (Sak.).
The Zebra wood of English commerce is said to be the produce of Brazil and Rio Janeiro, and its botanical source is unknown. *Connarus guianensis*, Lam.; a large tree of British Guiana, is also said to furnish Zebra wood.

54. *Plectronia buxifolia*, Baker. Wood used in house building and for walking sticks. *Fàntsikàhitra* (Ank.).

55. *Lecontea bojeriana*, A. Rich, and *L. farinosa*, Baker. Climbing plants which yield a black dye. (Woody places of Cent. and E. Reg.) *Laingo* or *Laingomaimbo.*

Compositæ.

56. *Vernonia Merana*, Baker. A tree whose wood is used in house building. (Cent. Reg.) *Mèrana* (Bets.).

57. *Psiadia dodonæfolia*, Steetz. The natives use the leaves of this plant for annealing new water pitchers. (Widely spread in the island.) *Dìngadìngana.*

Sapotaceæ.

58. *Labramia* (*Delastrea*) *Bojeri*, A. DC. A tree from which the Betsimisaraka obtains a kind of dye. It is possibly the *Nato* whose bark is abundantly employed as a dye in Imerina. (E. Reg.) *Nànto* (Betsim).

59. *Mimusops? costata*, Hartog. A small tree with edible fruit. It also yields a fibre. (River sides near E. Coast.) *Todìnga* or *Vòajàba* (Betsim).

Ebenaceæ.

60. *Diospyros, sp.* Affords a valuable ebony exported to Europe (W. Reg.) *Mpìngo* or *Lompìngo* (Sak.).

Apocynaceæ.

61. *Landolphia, spp.* Climbing plants which yield the native india-rubber, *Vàhy.* Two of the species of *Landolphia* here referred to as yielding Madagascar rubber have been described as *Vahea madagascariensis*, Bojer, and *V. gummifera*, Lam.

62. *Alyxia lucida*, Baker. A shrub whose bark and leaves are employed in the manufacture of native rum. (W. Reg.) *Andrìambàvifòhy* (Sak.).

63. *Cerbera* (*Tanghinia venenifera*, Poir.). Affords the fruit formerly employed in the "Tangèna" ordeal. (E. Coast.) *Tangèna.*

Asclepiadeæ.

64. *Cryptostegia madagascariensis*, Bojer. A shrub, the bark of which is used by the Sakalava in the manufacture of rum, and its fibre for fishing lines. (W. Reg.) *Lombiro* (Sak.).

Loganiaceæ.

65. *Nuxia sphærocephala*, Baker, and *N. terminalioides*, Baker. The wood of these trees is employed in house building. (Forests of E. Reg.) *Lambìnana.*

66. *N. capitata*, Baker. A hard-wooded tree whose wood is used in house building. (E. and Cent. Regs.) *Vàlanìrana.*

67. *Buddleia madagascariensis*, Lam. The berries of this shrub appear to be used in some parts of the island in the manufacture of rum, its flowers in dying the cloth called "Jiafòtsy," and its leaves were formerly used as a substitute for soap. (Widely spread in the island.) *Sèva.*

68. *Anthocleista amplexicaulis*, Baker. A large-leaved shrub, some part of which the natives employ for malarial fever. (In and about upper forests of E. Reg.) *Landèmy.*

69. *A. rhizophoroides*, Baker. A tree whose wood is used in house building. (Forests of E. Reg.) *Vàriàhy.*

Scrophularineæ.

70. *Buchnera leptostachya*, Benth. A herb with which the natives stain their teeth. *Tambòlo.*

Bignoniaceæ.

71. *Colea Telfairiæ*, Bojer. A small tree with hard and durable wood. (Open country in Cent. Reg.) *Hìtsikìtsika.*

72. *Phyllarthron bojerianum*, DC. A shrub or small tree whose wood is variously employed. (Cent. and E. Regs.) *Zàhana.*

Acanthaceæ.

73. *Rhinacanthus communis*, Nees. The seeds are used for scenting clothes. (Cent. Reg.) *Vòanàlakèly.* The roots of this plant are used in China under the name of Tong-pang-chong, and in India under that of Nagamullie, in certain forms of skin disease.

LABIATÆ.

74. *Moschosma polystachyum*, Benth. The Musk Basil. (E. Coast.) *Karànjamboay* (Betsim).

75. *Tetradenia fruticulosa*, Benth. A shrub, the juice of which is said to produce violent vomitting. (Cent. Reg.) *Boròna.*

PHYTOLACCACEÆ.

76. *Phytolacca abyssinica*, Hoffm. This shrub possesses purgative properties, but has to be used with care, as it is a violent poison. (Woody places of Cent. Reg. chiefly.) *Vàhivòraka.*

PIPERACEÆ.

77. *Piper borbonense*, C. DC., and *P. pachyphyllum*, Baker. Closely allied to the Cubeb, black and long peppers. (Forests of E. Reg.) *Tsimpèrifèry.*

MONIMIACEÆ.

78. *Tambourissa, spp.* Various species of this genus are employed in house building. (Forests of E. Reg.) *Ambòra.*

LAURINEÆ.

79. *Ravensara aromatica*, Sonn. A tree whose strongly aromatic bark is employed in the manufacture of rum. The leaves are said to be used as a condiment, and the aromatic fruit is known as Clove nutmeg. (Forests of E. Reg.) *Hăvòzomangìdy.*

80. *Ocotea trichophlebia*, Baker. Used in house building. (E. Reg.) *Varòngy.*

PROTEACEÆ.

81. *Dilobeia Thouarsii*, R. and S. A large hard-wooded tree. (Forests of E. Reg.) *Vivaona.*

THYMELÆACEÆ.

82. *Dais glaucescens*, Dene. The fibre of this shrub is used as string. (Cent. Reg.) *Avòha* or *Havòha.*

EUPHORBIACEÆ.

83. *Euphorbia primulæfolia*, Baker. A very small herb used as a rat poison. It possesses violent purgative properties. (Cent. Reg. in Vakin Ankaratra and at Antongodrahoja.) *Sòamalòndona.*

84. *Uapaca clusiacea*, Baker. A shrub used largely in feeding silk-worms. It produces an edible fruit. (Abundant in W. Imer. and occurring at a few other places.) *Tapìa.*

85. *U. clusioides*, Baker. A large tree with edible fruit. (Forests E. Antsih.) *Vòampàka* (Antsih).

86. *Antidesma madagascariensis*, Lam. A tree with edible fruit (W. Reg.) *Varòna* (Sak.). The fruits of *A. Bunius*, Spreng., a plant found throughout the hotter parts of India, Ceylon, and the Malay Islands; have a sub-acid taste, and are used in Java for preserving.

87. *Macaranga ferruginea*, Baker. A tree whose "stems contain an abundant supply of resin, the nature of which requires investigation." (W. Imer.) *Molànga*. Almost all the species of *Macaranga* in the island yield useful wood.

Urticaceæ.

88. *Chætacme madagascariensis*, Baker. A hard-wooded spiny tree. (Forests of E. Reg.) *Hìdina* and *Fanìdy*.

89. *Ficus soroceoides*, Baker. The leaves are rough, and are used as a substitute for sand paper. *Ampàly*.

Coniferæ.

90. *Podocarpus madagascariensis*, Baker. This tree affords a valuable wood much used in carpentry and house building. (Forests of E. Reg.) *Hètatra*.

Cycadaceæ.

91. *Cycas Thouarsii*, R. Br. The natives are said to obtain from its stem a kind of false sago. (E. Coast.) *Fàho* (Betsim).

Scitamineæ.

92. *Hedychium flavescens*, Carey, and *H. peregrinum*, N. E. Brown. These plants afford a kind of ginger. *Sàkamalao*. The sliced rhizomes of *H. spicatum*, Ham., form the principal ingredient in the scented powder known as *Abir*, used by Hindoos; and they are also used in India as a carminative tonic.

93. *Amomum Daniellii*, Hook. f. The Malagasy Cardamom. (E. and W. Regs.) *Longòza*. The pulp of the fruit is eaten by the negro races of Guinea for its agreeable acid flavour and refrigerant qualities.

Taccaceæ.

94. *Tacca pinnatifida*, Forst. Yields arrowroot. Doubtfully native. *Tavòlo*. This forms an important article of food in the South Sea Islands.

Dioscoreaceæ.

95. *Dioscorea, spp.* Various species of *Dioscorea* found wild in the forests have large edible tubers. (Forests, chiefly in E. and Cent. Regs.) *Ovinàla* or *Oviàla*.

Liliaceæ.

96. *Drimia Cowanii*, Ridley. The bulb of this plant is employed by the Betsiles as a rat poison. (Cent. Reg.) *Tongòlobòalàvo* (Bets.).

Palmæ.

97. *Raphia Ruffia*, Mart. The midrib of the leaf of this palm, which sometimes reaches 35 to 40 feet in length, is used chiefly for poles for ladies palanquins, ladders, &c. The fibre from the young unopened leaves is employed as string, and is largely exported to Europe under the name of "Raphia Grass." Various kinds of cloth, which are known as "Jàbo," "Jiafòtsy," "Sandiadiaka," and "Sìkinivòla," are made from the fibre. From the stem the natives obtain a sweet liquid called "Haràfa," and the shells of the fruits are employed as receptacles for various small articles and as snuff boxes. (Widely spread in the island, but always in valleys.) *Rofià* or *Fòmby*.

98. *Hyphæne coriacea*, Gærtn. A fan palm, whose fruit the Sakalava largely use in the manufacture of rum. (W. Reg.) *Sàtrana* or *Satramìra* (Sak.).

Pandaneæ.

99. *Pandanus, spp.* Hats are made from the leaf fibres of some of the species, the leaves of one of them found on the east coast are used, when dried, as covers for packages, and effectually secures them from rain. *Vakòana, Hòfa*, &c.

Aroideæ.

100. *Typhnodorum lindleyanum*, Schott. The fruit, after long boiling, is sometimes eaten by the natives. (E. and W. Reg. chiefly.) *Vòha.*

Cyperaceæ.

101. *Cyperus latifolius*, Poir. Commonly employed in the thatching of houses. (Widely spread in marshes.) *Hèrana.*

102. *C. imerinensis*, Bœckl. A sedge nearly allied to the Egyptian papyrus. The flowering stems when strung together are largely used for native doors, &c. Mats are made from strips of the same. (Widely spread in marshy places.) *Zozòro, Zòrozòro*, and *Bilo.*

103. *Heleocharis plantaginea*, R. Br., and *H. Baroni*, Baker. Used in making mats, baskets, and hats. (Marshes in Cent. Reg.) *Harèfo.*

104. *Scirpus paludicola*, Kunth., var. *decipiens*, Nees. Employed in making mats, baskets, &c. (Cent. Reg. chiefly.) *Hàzondràno.*

105. *Lepironia mucronata*, Rich. Used in the manufacture of hats, also employed by the Betsimisaraka women in making sugar bags, which are exported to Mauritius. (E. Coast.) *Pènja* (Betsim). This species is found also in China, where it is largely used for making mats.

Gramineæ.

106. *Stipa madagascariensis*, Baker. Employed in making native baskets, &c. (Cent. Reg.) *Hàravòla.* The plant is closely allied to the esparto (*S. tenacissima*, L.) of Spain and N. Africa, so largely used for paper making.

107. *Sporobolus indicus*, R. Br. Used in the manufacture of hats (Widely spread in the island.) *Tsindròdròtra.*

108. *Cephalostachyum Chapelieri*, Munro. A bamboo employed for numerous purposes. (Forests of E. Reg.) *Vòlotsàngana.*

LICHENES.

109. *Roccella fusiformis*, Ach. A lichen which yields the dyeing material named orchil. (Island of Nòsivỳ, and probably other places in St. Augustine's Bay, S.W. Madagascar.)

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Nuxia capitata, Baker, 66.
— sphærocephala, Baker, 65.
— terminalioides, Baker, 65.

O.

Ochna, sp., 19.
Ocotea tricophlebia, Baker, 80.
Odifònga, 30.
Otaheite apple, 24.
Ovinàla, 95.
Oviàla, 95.

P.

Panax, spp., 47.
Pandanus, spp., 99.
Pavonia Bojeri, Baker, 10.
Pènja, 105.
Phyllarthron bojerianum, DC., 72.
Phytolacca abyssinica, Hoffm., 76.
Piper borbonense, C. DC., 77.
P. pachyphyllum, Baker, 77.
Piptadenia chrysostachya, Benth, 36.
Plectronia buxifolia, Baker, 54.
Podocarpus madagascariensis, Baker, 90.
Psiadia dodonæfolia, Steetz, 57.

R.

Ràmy, 1.
Ranga or Ràngy, 19.
Raphia grass, 97.
Raphia Ruffia, Mart., 97.
Ravensara aromatica, Sonn., 79.
Rhinacanthus communis, Nees., 73.
Rhodolæna bakeriana, Baill., 8.
Rhus Taratana, Baker, 23.
Roccella fusiformis, Ach., 109.
Rofià, 97.
Rourea platysepala, Baker, 26.

S.

Sàkamalao, 92.
Sakòana, 24 and 25.
Salacia dentata, Baker, 22.
Salay, 43.
Sandiadiaka, 97.
Satramìra, 98.

Sàtrana, 98.
Schismatoclada, spp., 49.
Scirpus paludicola, Kunth., var. decipiens, Nees., 104.
Sclerocarya caffra, Sond., 25.
Sèva, 67.
Sìkinivòla, 97.
Sòamalòndona, 83.
Sòdindrànto, 48.
Sohìhy, 48.
Spondias dulcis, Forst., 24.
Sporobolus indicus, 107.
Stipa madagascariensis, Baker, 106.
— tenacissima, L., 106.
Symphonia clusioides, Baker, 1.
— globulifera, L., 1.

T.

Tacca pinnatifida, Forst., 94.
Tamarindus indica, 34.
Tambàribarìsa, 53.
Tambòlo, 70.
Tambourissa, spp., 78.
Tàndroròho, 35.
Tangèna, 63.
Tanghinia venenifera, Poir, 63.
Tapìa, 84.
Taràtana, 23.
Tavòlo, 94.
Tetradenia fruticulosa, Benth., 75.
Todìnga, 59.
Tongòlobòalàvo, 96.
Tong-pang-chong, 73.
Trachylobium verrucosum, L., 35.
Tsiènimpòsa, 46.
Tsìmatra, 22.
Tsìmpèrifèry, 77.
Tsindròdròtra, 107.
Tsitsìhina, 41.
Tsòntsona, 10.
Typhnodorum lindleyanum, Schott, 100.

U.

Uapaca clusiacea, Baker, 84.
— clusioides, Baker, 85.
Urophyllum Lyallii, Baker, 51.

V.

Vahea gummifera, Lam., 61.
— madagascariensis, Bojer, 61.
Vàhivòraka, 76.
Vàhy, 61.
Vakòana, 99.
Vàlanìrana, 66.
Vànana, 17.
Vàntsìlana, 47.
Vàriàhy, 69.
Vàro, 11.
Varòna, 86.
Varòngy, 80.
Vasèfaka, 27.
Vernonia Merana, Baker, 56.
Vìha, 100.
Vintànina, 5.
Vivaona, 81.
Vòajàbo, 59.
Vòambòana, 31.
Vòampàka, 85.
Vòampìka, 26.
Vòanàlakèly, 73.
Voànana, 17.
Voàntsìmatra, 22.
Vòasèfaka, 27.
Vòlombòrona, 37.
Vòlotsàngana, 108.
Vorètra, 23.

W.

Weihea sessiliflora, Baker, 42.
Weinmannia, spp., 38.
— Rutenbergii, Engl., 39.

X.

Xerochlamys pilosa, Baker, 7.

Z.

Za, 12.
Zàhana, 72.
Zebra wood, 53.
Zòrozòro, 102.
Zozòro, 102.

CLXVIII.—CLIMATE OF ZANZIBAR.

The British protectorate over Zanzibar having again been resumed, the following meteorological table is published as likely to be useful to persons who may have business relations with the island. It brings out in a striking way the singular uniformity of the climate and small annual range. It was communicated to Kew by Sir John Kirk, G.C.M.G., the late Political Agent and Consul-General.

TABLE showing extreme TEMPERATURE for each Month of the Year 1878. Readings taken in the shaded but open corridors of the Residency, unaffected by sun and sky radiation.

Month.	Temperature.	
	Maximum.	Minimum.
	°	°
January - - -	87·9	79·4
February - - -	88·3	78·0
March - - -	87·3	78·6
April - - -	85·0	74·9
May - - -	84·9	75·0
June - - -	82·2	74·6
July - - -	82·3	72·0
August - - -	82·9	74·6
September - - -	82·8	73·1
October - - -	83·8	74·9
November - -	84·2	76·9
December - - -	85·4	76·5

	°
Highest of the year (February) - -	88·3
Lowest „ (July) - - -	72·0
Extreme range - - - -	16·3